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(54) METHOD OF BLOW-MOULDING A CONTAINER

(71) We, BAXTER TRAVENOL LABORATORIES INC., a Corporation organised and existing under the laws of the State of Delaware, USA, of One Baxter Parkway, Deerfield, Illinois 60015, USA, do hereby declare the invention for which we pray that a Patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:-

The invention relates to a method of blow-moulding containers.

Flexible, flat-collapsible containers or bags made of plastics materials have achieved very significant commercial acceptance in the field of parenteral solution bags and blood bags. Initially, these items were made from heat-sealed vinyl plastics sheets, and were quite satisfactory. However, it has been recognized that significant costs can be saved by the use of other manufacturing procedures such as blow-moulding. Also, there has been consideration of the use of less expensive materials than vinyl plastics sheets in containers, particularly those materials that do not contain a plasticizer. For example, polyproplene has been considered a suitable candidate for use as a container material, when extruded as a thin, flexible sheet.

The present invention provides a method of blow moulding a container from a softened plastics tubular parison which comprises selectively heating the parison so that one end is hotter and softer than the remaining portion, inflating the parison in a chamber of the blow mould at a relatively low inflation pressure to cause the hotter, softer portion of the parison to balloon outwardly within the mould beyond the remaining portion, and inflating the parison with a relatively high inflation pressure to cause the parison to expand to the shape of the mould chamber to produce a container in which the wall portions formed by the ballooned portions of the parison are less thick than the other portions, and accordingly are more readily collapsible during use of the container.

This method is particularly advantageous when, as is the case of the container shown in the accompanying drawings, the shape of the blow moulded chamber adjacent the hotter softer portion of the parison is relatively narrow in one dimension. In this instance, the ballooning action of the selectively heated parison facilitates the expansion of the parison to fit the shape of the mould chamber in the narrow section. In the absence of such ballooning prior to closing of the mould, the parison material in the vicinity of the narrow section of the blow mould chamber may come into contact with the mould walls, and accordingly cool prior to stretching completely into the narrow shape of the mould chamber, resulting in a defective container.

The invention is hereinafter particularly described with reference to the drawings of which:-

Figure 1 is an elevational view of a flexible container made in accordance with this invention, with a portion of its mould shown, and with a preliminary stage of the shape of the container during moulding being shown;

Figure 2 is an elevational view of the same container, rotated 90°, and shown in conjunction with its mould, portions of the mould being broken away;

Figure 3 is a highly-magnified, longitudinal sectional view, taken along line 3-3 of Figure 1, showing in detail the structure of the sealed tail end portion of the container;

Figure 4 is a plan view of a parison section being heated by strip heaters prior to moulding of the softened parison section as described herein.

Referring to the drawings, flexible, flat-collapsible container 10 is shown to be made from a heated tubular parison of softened polypropylene plastics material or the like by a convention blow-moulding process, involv-

ing body mould halves 14, 16 for forming the body of container 10, and head mould halves 18, 20 for forming the head portion 22 of the container. As shown in Figure 2, the head portion 22 formed by mould halves 18, 20 is a relatively thick, rigid open tube, and defining a bore communicating with the interior of container 10.

Any conventional closure may be used to seal the container. For example, a moulded plastics closure member can be sealed in place across the mouth of head portion 22, having puncturable diaphragms for access into the container. An overcap can also be attached after moulding, for example an overcap similar to that disclosed in Weiler U.S. patent No. 3,730,372.

Blow-moulding in general is a well-developed arm of technology, and many different techniques of blow-moulding are currently available to those skilled in the art and which are usable for manufacturing the container.

Typically, a separately-extruded tubular parison section 27 is grasped by gripper 29 and placed between mould halves 14, 16 and head mould halves 18, 20. Blowing tube 36 is then placed into the parison from the bottom, and pressurized air at a pressure of about 8 p.s.i. is provided through the blowing tube, prior to or as mould halves 14, 16 close. A plug is mounted upon blow tube 36 to close neck portion 22 of the container 10 formed from the parison 27, so that, as the head moulds 18, 20 close, the parison can be inflated to approximate the desired final structure.

As shown in Figure 4, parison 27 may be typically selectively preheated with conventional parison strip heaters 31, 33. Strip heaters 31 are adjusted to produce a greater heat output than heaters 33.

Thus, parison 27 is heated to a higher temperature with respect to its upper third, when compared with the rest of the container, prior to closing of the mould. As a result, the upper third of parison 27 is somewhat softer. The exact heating conditions are empirical, and must be individually determined for the particular equipment used, to obtain the desired results on such equipment.

Accordingly, upon the 8 p.s.i. inflation, a preliminary bubble 35 is shown in Figure 1 to be formed by ballooning outwardly in the parison 27, being illustrated in phantom lines. This is an intermediate configuration of the parison, prior to formation of the final configuration, which is container 10 as shown in the drawings in full lines.

It can be seen that pre-expansion of the upper portion of parison 27 facilitates the complete filling of the narrow, upper end 37 of the mould (Figure 2) by the softened, ballooned parison end, as the mould closes.

After formation of the intermediate configuration of parison 27 as shown in Figure 1, and after closing of the mould halves 14, 16, 18 and 20, high pressure air is introduced to blowing tube 36 at a pressure of about 110 p.s.i., to cause the parison to assume the shape of the mould cavity, as shown in the drawings. Typically, during this phase of the operation, up to about five ton total pressure can be applied against the mould halves to counterbalance the internal air pressure, while creating the tail seal described previously.

The walls of the upper third of the container, as shown in the drawings, are generally thinner than the walls of the lower two thirds, which provides the advantage of permitting a uniform collapse as the container is emptied of solution, beginning at the end having hanger piece 38, and slowly proceeding down the container as the liquid is removed through head portion 22. The difference in wall thickness changes gradually, typically ranging from about 0.01 inch at end 37 to 0.02 inch in the vicinity of shoulder portions 42.

After the inflation process is complete, and the newly-formed container has cooled sufficiently to retain its shape, the portion of parison 27 which projects upwardly out of the mould may be cut away, and the mould opened so that the container drops out. Thereafter, an appropriate closure can be placed upon head portion 22 of container 10.

If desired, head mould halves 18, 20 may close on parison 27 prior to the closing of mould halves 14, 16, to pre-form the head portion 22.

The present invention is particularly useful for sealing biaxially oriented containers. The process of biaxial orientation makes the formation of a good tail seal more difficult, due to cooling of the parison during the orientation process, but the present invention can be effectively utilized in that circumstance.

Flat plastics hanger piece 38 is made from an end section of the parison by moulding as shown, to be formed integrally with container 10, and extending substantially the entire width of the container. An aperture 40 is generally provided in hanger piece 38, being generally formed during or after moulding by cutting or the like, to facilitate hanging of the container in the position indicated in Figure 1. Hanger piece 38 can also be shaped after moulding by cutting into a shape as indicated in phantom lines in Figure 1.

The container 10, in as-moulded form, defines a shoulder portion 42 integral with head portion 22. The container also includes various gusset portions 44 defining certain lines of folding weakness, and longitudinal line of folding weakness 45, to facilitate the collapse of the bag in the manner illustrated in patent specification no. 1,517,359.

Container 10 defines a tail end portion 46 which, in turn, defines a sealed line 48, joining opposite sides 50, 54 of tubular container 10 into a sealed end.

Sealed line 48 is formed by bringing the respective container walls 50, 54 together by mould halves 14, 16, and effecting a heat seal along line 48. As shown in Figure 1, line 48 extends substantially the entire width of container 10.

Hanger piece 38 is formed in the parison 27 by the mould into a flat piece, adjacent its end. Hanger piece 38 is integral with sealed line 48 and extends away therefrom.

The sealed end of tail portion 46 of container 10 is moulded to define a recess 56, formed by the container walls, which is directed inwardly to the interior of container 10 to form a bellows-like structure at the end of container 10 as shown in Figure 3. Recess 56 extends the entire length of seal line 48, and serves as a protection means for it, reducing the likelihood that rupture will take place in the vicinity of seal line 48 upon exposure to shock generated by dropping of the filled container or the like.

Recess 56 is formed by protruding portions 58 of mould sections 14, 16, which result in the formation of recessed wall portions 56.

Mould halves 14, 16 also define relatively enlarged, semi-cylindrical chamber portions 60, relative to the mould chamber portions 62 immediately adjacent to portions 60, which also extend the length of seal line 48. The purpose of these relatively enlarged, semi-cylindrical chamber portions is to produce corresponding container wall portions 64, which are semi-cylindrical in cross-section, which serve as shock-absorbers for the sealed end of tail portion 46.

Flat hanger piece 38 also defines a pair of spaced rods 70 which are integral with piece 38, and extend the entire width of the container. Between rods 70 is an intermediate portion 71 of piece 38, which is shown to be approximately one half the thickness of the remainder of piece 38 which is spaced from rods 70. For example, the thickness of portion 71 can be about 0.01 to 0.02 inch and the outer portion of piece 38 is about twice as thick.

This is accomplished by providing in each mould half 14, 16 land areas 75 positioned between transversely-extending channels 69 in registry with each other, each typically projecting outwardly relative to the remaining area 76 of the tail piece-forming portions of mould 14, 16 by at least about 0.005 inch, to cause the thinning of portion 71.

Accordingly, when mould halves 14, 16 are brought together to form flat piece 38 by collapsing the end of a tubular plastics parison, the majority of the entire compressive force exerted between the two mould halves by pistons 28, 30 is focused in land area 75 between transversely-extending channels 69. As a result, the plastics in land area 75 is placed under sufficient compression to force plastics to flow out of area 75 in the opposite directions as indicated by longitudinal axis 68, to fill the transversely extending channels 69 defined in mould havlves 14, 16, resulting in the creation of rods 70. As stated above, the shearing action resulting from this flow substantially obliterates, in portion 71, the junction line 78 between opposite sides of the plastics parison. This results in a seal of improved strength in the area of rods 70 and thin portion 71.

A typical container may be proportioned to contain a litre of parenteral solution.

Generally the container may have an average wall thickness at the tail portion thereof of no more than about 0.05 inch, and particularly from around 0.01 to 0.02 inch, in order to obtain the most significant improvement in sealing over the sealing methods of the prior art. Accordingly, the flat plastics piece at its outer portion, in the vicinity of reference numeral 78, may have a thickness of about 0.02 to 0.04 inch, for example 0.03 inch, while intermediate portions 71 between the rod members 69 may accordingly have a thickness of about 0.01 to 0.02 inch, e.g. 0.015 inch.

The distance of the strengthened tail seal portion from seal line 48 to upper portion 72 may be, for example 0.187 inch, with the remaining structure of Figure 3 being of proportionate size.

When filled with a liquid, the container can be expected to assume shapes other than that ideally shown in the drawings, in which said container shown is in as-moulded condition. The exact shape of the filled container will vary from moment to moment with handling and with its orientation to the vertical, since it is made of flexible material.

Performance of the invention as described above involves use of the invention described and claimed in patent application no. 45494/78 (Serial No. 1,556,243).

WHAT WE CLAIM IS:-

1. A method of blow moulding a container from a softened plastics tubular parison which comprises selectively heating the parison so that one end is hotter and softer than the remaining portion, inflating the parison in a chamber of the blow mould at a relatively low inflation pressure to cause the hotter, softer portion of the parison to balloon outwardly within the mould beyond the remaining portion, and inflating the parison with a relatively high inflation pressure to cause the parison to expand to the shape of the mould chamber to produce a container in which the wall portions formed by the ballooned portions of the parison are less thick than the other portions, and accordingly are

more readily collapsible during use of the container.

2. A method according to Claim 1, in which the shape of the blow mould chamber, adjacent said hotter, softer portion of the parison, is relatively narrow in one dimension.

3. A method according to Claim 2, in which opposite sides of the ballooned end of the parison are collapsed together in the mould to combine them to form a tail strip of the container and a segment of the tail strip is compressed by the mould with a force sufficient to cause the plastics material to flow in opposite axial directions to form a pair of spaced rod portions extending transversely to the axial directions and separated by a portion of the tail strip that is less thick.

4. A method according to Claim 3, in which the portion of the tail strip between the rod portions which are formed is pressed to approximately one half of its original thickness.

5. A method according to Claim 1, 2, 3 or 4 in which the heat-softened plastics parison is a biaxially oriented plastics material.

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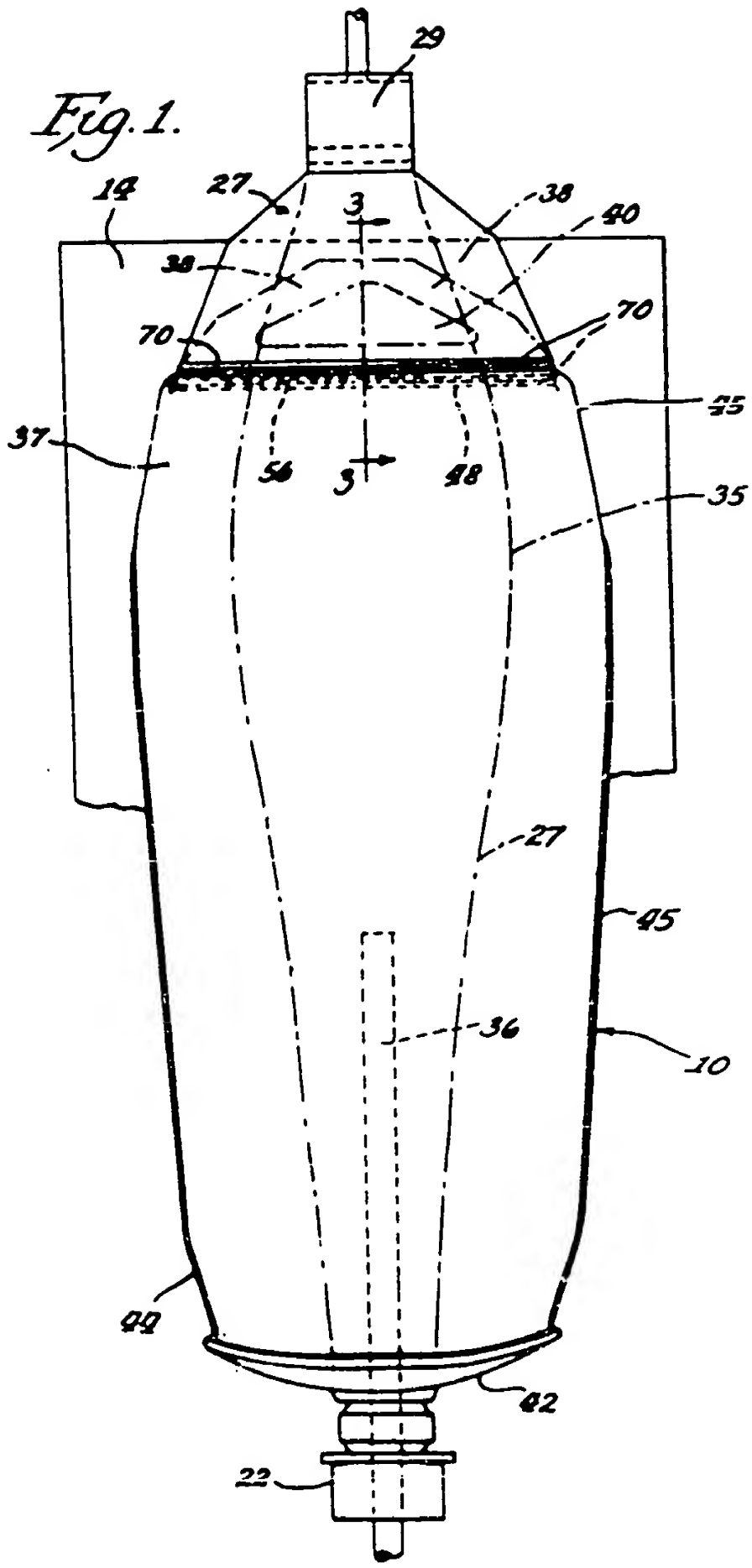
2 SHEETS This drawing is a reproduction of the Original on a reduced scale

Sheet 1

Fig. 1.



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Sheet 2

Fig.2.

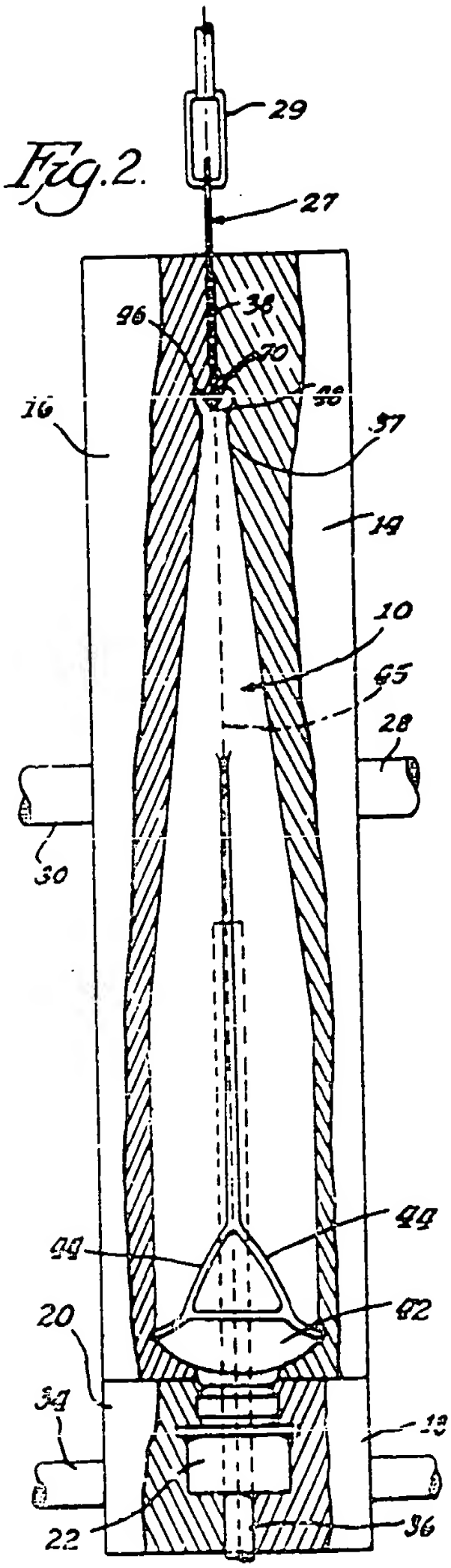

Fig.3.

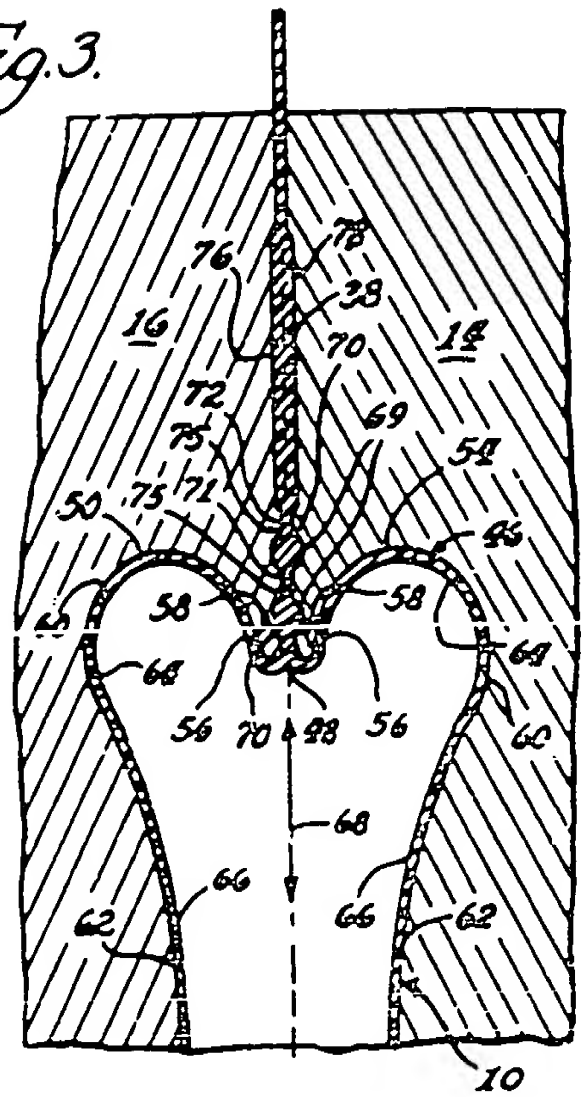

Fig.4.